High-P_T muon trigger efficiencies for Period 9 and Period 10

Samples

- **Data**
  - Period 9 dataset bhmumi (runs 222529 - 228596) ~ 165 pb^{-1}
  - Period 10 dataset bhmumi (runs 228664 - 233111) ~ 255 pb^{-1}
  - v16 of goodrun list (no silicon)
  - Total Lumi = 1.604 fb^{-1}

Trigger Efficiency

Use the two legs from the reconstructed Z (both legs pass muon ID and fiducial cuts)

Level 1:

$\varepsilon^{L1}{}_{CMUP}$ is calculated from 2 independent samples, using CMUP-CMUP and CMUP-CMX samples:

$$\varepsilon^{L1(A)}_{CMUP} = \frac{\#\text{ of events with both legs triggered}}{\#\text{ of events with 1 CMX leg triggered}}$$

$$\varepsilon^{L1(B)}_{CMUP} = \frac{2R}{1+R}$$

$$R = \frac{\#\text{ of events with both legs triggered}}{\#\text{ of events with} \geq 1\text{ CMUP leg triggered}}$$

The final efficiency is an average of $\varepsilon^{L1(A)}{}_{CMUP}$ and $\varepsilon^{L1(B)}{}_{CMUP}$ weighted by the errors.

Level 2: (both leg pass L1)

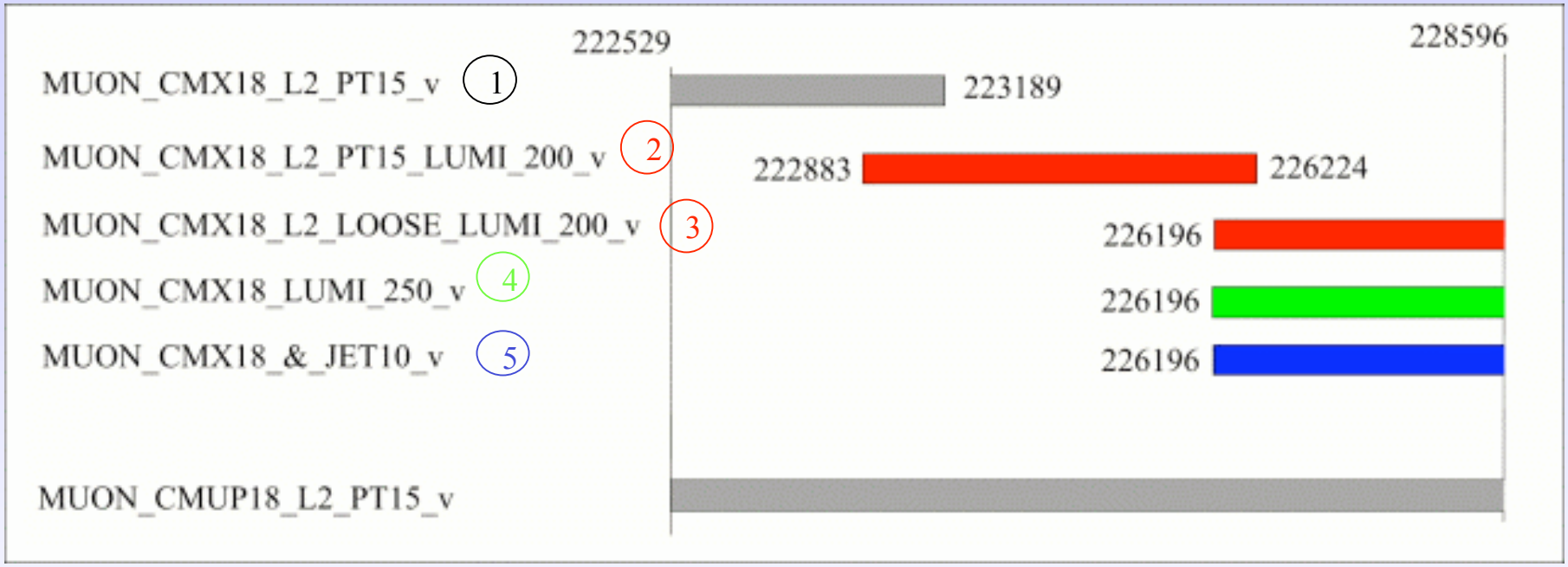
$$\varepsilon^{L2}_{CMUP} = \frac{\#\text{ of events pass both L2 triggers}}{\#\text{ of events pass L2 CMX trigger}}$$

Level 3: (both leg pass L2)

$$\varepsilon^{L3}_{CMUP} = \frac{\#\text{ of events pass both L3 triggers}}{\#\text{ of events pass L3 CMX trigger}}$$

CMX trigger efficiency is calculated in similar way.

CMX/CMUP trigger in period **9**



$$\varepsilon_{CMUP}^{L2} = \frac{\#\text{ of events pass both L2 triggers}}{\#\text{ of events pass L2 CMX trigger}}$$

Et cut

	bhmumi <223189	LUMI 200	LOOSE	SLAM	JET10 20
CMX eff. naming	**1**	**2**	**3**	**4**	**5**

Efficiency for "MUON_CMX18_LUMI_250" trigger is labeled: "SLAM"

Trigger Efficiency in Period 9

Level 1 trigger efficiency (%)

	bhmu0i2 p8	bhmumi p9
CMUP	92.57 ± 0.51	$94.18^{+0.50}_{-0.45}$
CMX	88.90 ± 0.77	$88.63^{+0.84}_{-0.83}$

Level 2 trigger efficiency (%)

	bhmu0i2 p8	bhmumi <223189	LUMI 200	LOOSE	SLAM	JET10 20
CMUP	≡ 100.0 ± 0.0	≡ $100.0^{+0.0}_{-0.0}$	$98.35^{+0.53}_{-0.74}$		-	
CMX	≡ 100.0 ± 0.0	≡ $100.0^{+0.0}_{-0.0}$	$91.98^{+1.48}_{-1.84}$	$96.13^{+1.04}_{-1.50}$	$96.20^{+1.17}_{-1.57}$	$100.0^{+0.0}_{-4.73}$

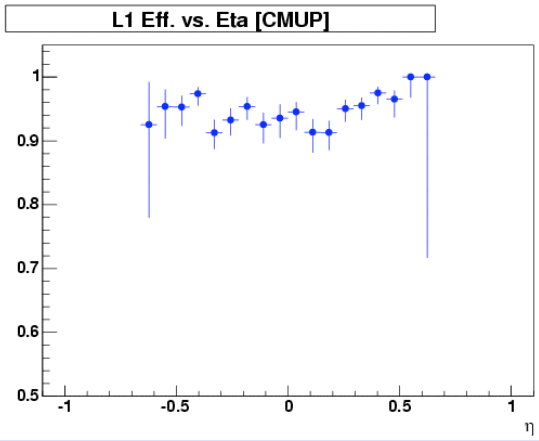
Level 3 trigger efficiency (%)

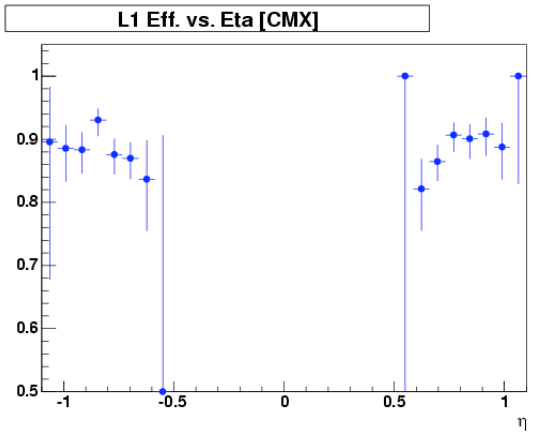
	bhmu0i2 p8	bhmumi <223189	LUMI 200	LOOSE	SLAM	JET10 20
CMUP	98.63 ± 0.38	$98.70+^{0.66}_{-1.29}$	$99.83^{+0.13}_{-0.38}$		-	
CMX	99.47 ± 0.24	$99.13^{+0.53}_{-1.13}$	$99.33^{+0.45}_{-0.89}$	$100.0^{+0.0}_{-0.62}$	$100.0^{+0.0}_{-0.73}$	$100.0^{+0.0}_{-4.73}$

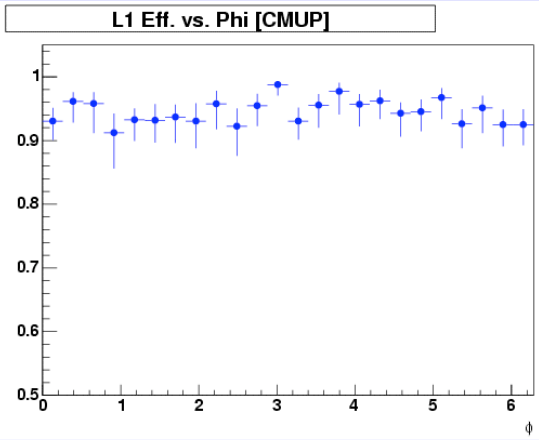
Combined trigger efficiency (%)

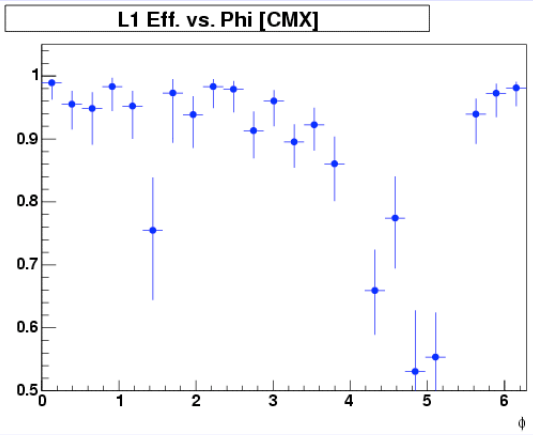
	bhmu0i2 p8	bhmumi <223189	LUMI 200	LOOSE	SLAM	JET10 20
CMUP	91.30 ± 0.61	$92.95^{+0.80}_{-1.48}$	$92.47^{+0.71}_{-0.90}$		-	
CMX	88.43 ± 0.79	$87.86^{+0.95}_{-1.47}$	$80.97^{+1.56}_{-1.92}$	$85.20^{+1.22}_{-1.63}$	$85.26^{+1.31}_{-1.72}$	$88.63^{+0.84}_{-5.99}$

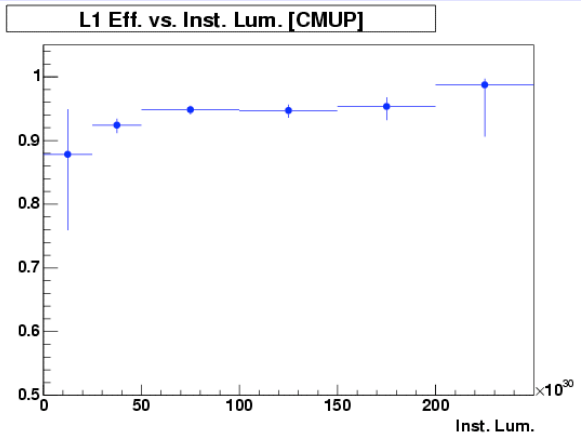
L1 Trigger Efficiency Period 9

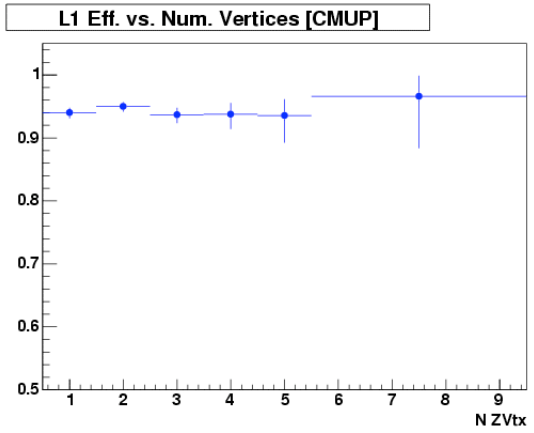


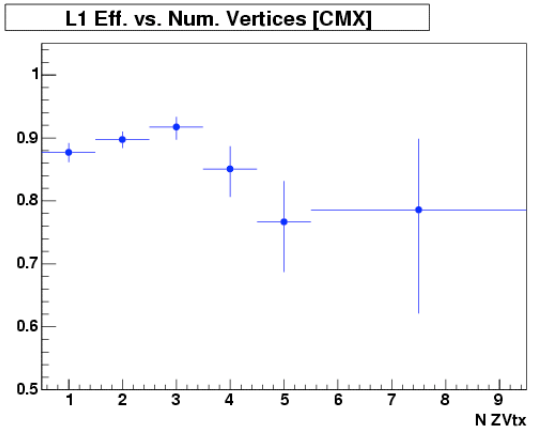


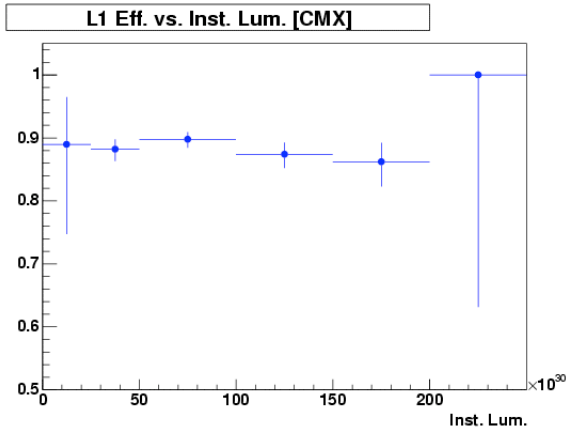




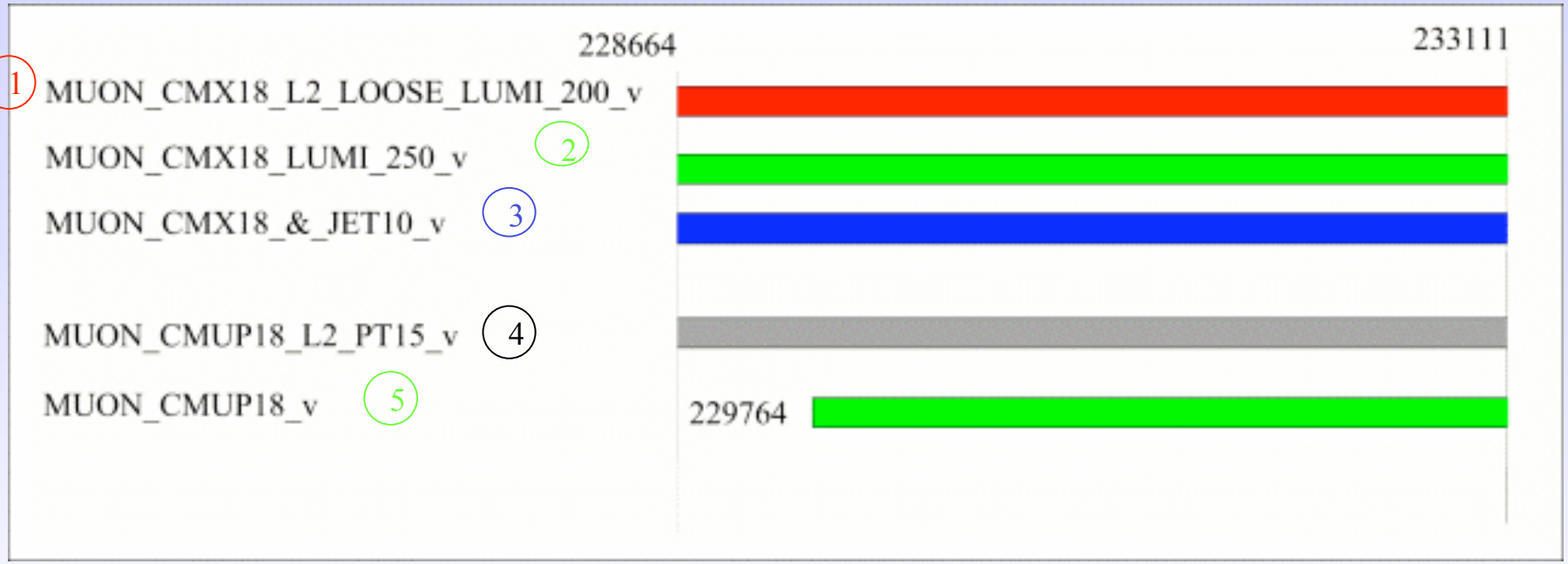








CMX/CMUP trigger in period **10**



$$\varepsilon_{CMUP}^{L2} = \frac{\#\ \text{of events pass both L2 triggers}}{\#\ \text{of events pass L2 CMX trigger}}$$

	LOOSE	SLAM1	SLAM2	JET10
CMUP	**4**		**5**	
CMX	**1**	**2**	**2 run>229764**	**3**

Trigger Efficiency in Period 10

Level 1 trigger efficiency (%)

	bhmu0i2 p8	bhmumi p10
CMUP	92.57 ± 0.51	$93.71^{+0.43}_{-0.40}$
CMX	88.90 ± 0.77	$91.23^{+0.61}_{-0.56}$

Level 2 trigger efficiency (%)

	bhmu0i2 p8	SLAM1	SLAM2
CMUP	100.0 ± 0.00	-	$98.56^{+0.39}_{-0.49}$
CMX	100.0 ± 0.00	$98.42^{+0.33}_{-0.45}$	$98.28^{+0.38}_{-0.50}$

Level 3 trigger efficiency (%)

	bhmu0i2 p8	SLAM1	SLAM2
CMUP	98.63 ± 0.38	-	$99.71^{+0.16}_{-0.28}$
CMX	99.47 ± 0.24	$99.44^{+0.21}_{-0.30}$	$99.32^{+0.27}_{-0.37}$

Combined trigger efficiency (%)

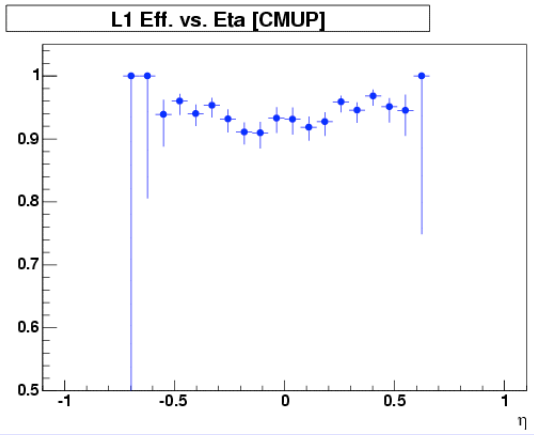
	bhmu0i2 p8	SLAM1	SLAM2
CMUP	91.30 ± 0.61	-	$92.09^{+0.58}_{-0.66}$
CMX	88.43 ± 0.79	$89.28^{+0.70}_{-0.73}$	$89.04^{+0.73}_{-0.78}$

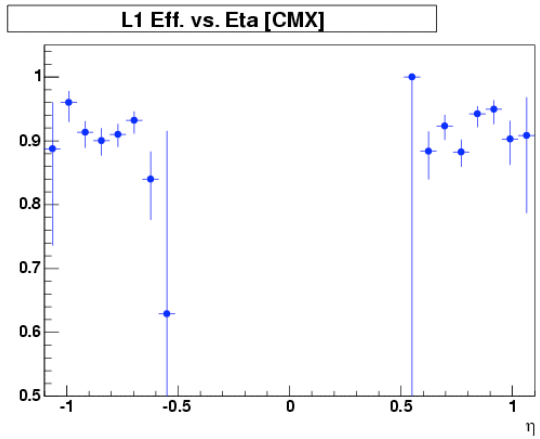
Lumi. cut	L2 LOOSE	L3 LOOSE	
$170*10^{30}$	$99.22^{+0.25}_{-0.34}$	$99.53^{+0.19}_{-0.27}$	CMX
$180*10^{30}$	$99.25^{+0.22}_{-0.32}$	$99.47^{+0.20}_{-0.29}$	
$190*10^{30}$	$98.98^{+0.26}_{-0.37}$	$99.48^{+0.19}_{-0.28}$	
$200*10^{30}$	$98.48^{+0.32}_{-0.41}$	$99.49^{+0.19}_{-0.28}$	
NO cut	$96.06^{+0.48}_{-0.60}$	$99.49^{+0.19}_{-0.28}$	
CMUP	$97.99^{+0.38}_{-0.45}$	$99.71^{+0.14}_{-0.23}$	

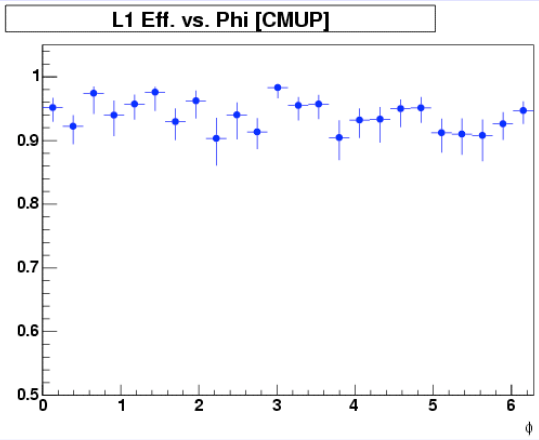
Jet Et cut (L5 corr.)	L2 CMX JET10	L3 CMX JET10
15 GeV	$82.71^{+2.35}_{-2.54}$	$97.94^{+0.93}_{-1.41}$
16 GeV	$86.59^{+2.18}_{-2.32}$	$97.90^{+0.88}_{-1.37}$
18 GeV	$94.59^{+1.60}_{-1.92}$	$97.61^{+1.12}_{-1.61}$
20 GeV	$96.91^{+1.24}_{-1.89}$	$97.86^{+1.06}_{-1.67}$
22 GeV	$98.77^{+0.79}_{-1.56}$	$97.50^{+1.23}_{-1.89}$
24 GeV	$98.58^{+0.93}_{-1.85}$	$97.10^{+1.43}_{-2.28}$
26 GeV	$99.21^{+0.65}_{-1.79}$	$96.80^{+1.54}_{-2.37}$

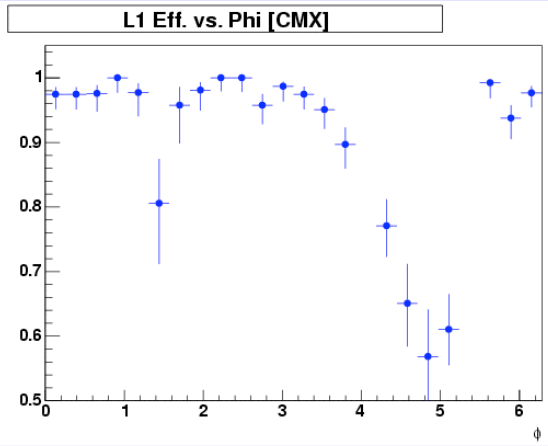
All in stat. errors., should not depend on L2 Et cut

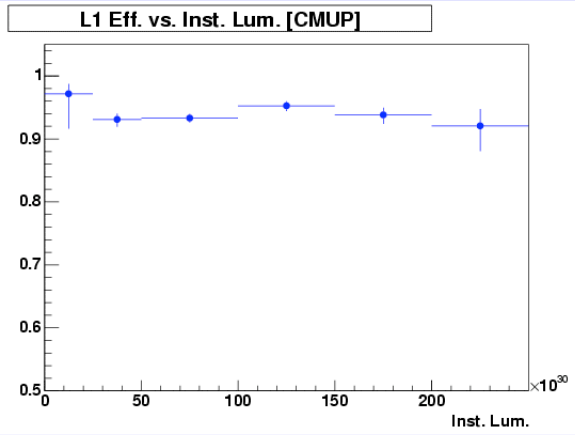
L1 Trigger Efficiency Period 10

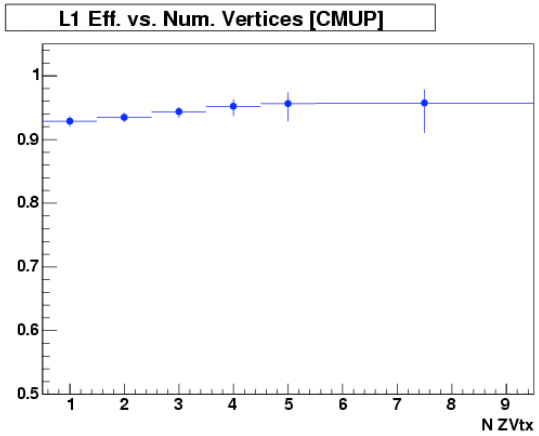


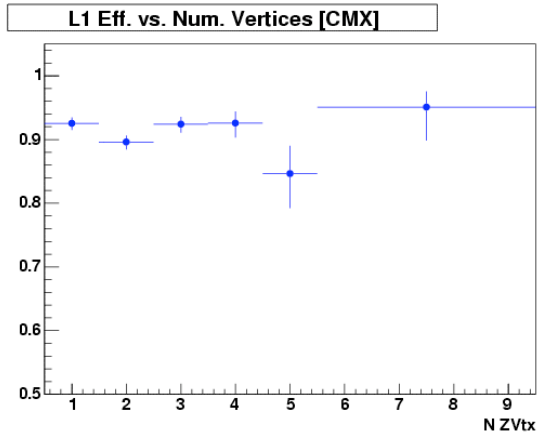


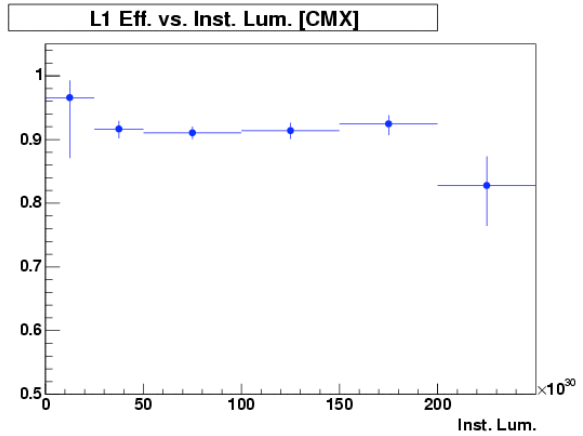












Trigger Efficiency conclusion

Period 9 trigger efficiencies final numbers are provided.

Period 10 trigger efficiencies look good, hope to be blessed soon.